LIQUIFIED NATURAL GAS MARINE TERMINAL ENGINEERING AND MAINTENANCE STANDARDS (LNGTEMS)

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- From the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990:

"The commission shall adopt rules, regulations, guidelines and commission leasing policies for reviewing the location, type, character, performance standards, size and operation of all existing and proposed marine terminals within the state, whether or not on lands leased from the commission, and all other marine facilities on land under lease from the commission to minimize the possibilities of a discharge of oil." (Sect. 8755 (a))

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- From the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990:

Oil is defined as “any kind of petroleum, liquid hydrocarbons or petroleum products or any fraction or residues therefrom, crude oil, bunker fuel… liquid distillates from unprocessed natural gas.”

MARINE OIL TERMINAL ENGINEERING AND MAINTENANCE STANDARDS (MOTEMS)

- Standards Completed and on the web (www.slc.ca.gov.gov/Division_Pages/MFD)
- Defines Specific Engineering Criteria for Both Existing and New MOTs
- Meets SLC mandate to protect the environment and ensure safe operations at marine oil terminals.
- MOTEMS – Effective February 6, 2006, initial audits due August 2008, Chapter 31 of the California Building Code.

LNG MARINE TERMINAL ENGINEERING AND MAINTENANCE STANDARDS (LNGTEMS)

- Funded by the California State Lands Commission, FY 2004 - 2008.
- Project officially started on April 19, 2005.
- Need for standards for California, as well as for the rest of the US.

LNG MARINE TERMINAL ENGINEERING AND MAINTENANCE STANDARDS (LNGTEMS)

FOUR POSSIBLE CONFIGURATIONS:

- **Deep water offshore mooring (LNG vessel + FSRU + riser/plem/pipelines)**
- **Conventional wharf/pier type, within a port**
- **Offshore and moored adjacent to an existing oil platform (mooring, platform requalification, riser/plem/pipelines)**
- **Gravity Based Structure (GBS) in relatively shallow water**

RISK LEVELS CONSISTENT WITH LOCATION

LNG MARINE TERMINAL ENGINEERING AND MAINTENANCE STANDARDS (LNGTEMS)

HAZARDS AND POTENTIAL LEAK ISSUES DIFFERENT FROM THOSE OF OIL TERMINALS OR PLATFORMS

- DISTANCE TO LFL OR LFL/2
- DISTANCE TO VARIOUS THERMAL RADIATION LEVELS
- EFFECTS OF CRYOGENIC BEHAVIOR OF STRUCTURAL MATERIALS.
- CASCADING OF EVENTS FOLLOWING A RUPTURE/SPILL.
- RISK DETERMINED SCENARIOS AND RESULTING LOADS (THERMAL, BLAST, CRYOGENIC, ETC.)

LNGTEMS STANDARDS

- STRUCTURAL PERFORMANCE CRITERIA AND ANALYSES
- MOORING CRITERIA AND ANALYSES
- PIPELINE & PIPELINE SUPPORTS CRITERIA
- MECHANICAL/ELECTRICAL EQUIPMENT
- MOUNTED EQUIPMENT/MOORING HARDWARE
- INSPECTION AND MAINTENANCE REQUIREMENTS

LNGTEMS STANDARDS (Continued)

- GEOTECHNICAL CRITERIA
- FIRE DETECTION/SUPPRESSION SYSTEMS
- DISPERSION & RADIATION CRITERIA AND ANALYSES
- GENERAL DESCRIPTION OF REQUIREMENTS FOR A RISK ASSESSMENT.

  OTHER ISSUES/COMPONENTS NECESSARY FOR THE TRANSFER OF LNG

LNGTEMS TEAM

- Primary contractor: Halcrow HPA, Oakland, CA
- Sub-contractors:
  - Aker Kvaerner, Houston, TX
  - Energo Engineering, Houston, TX
  - Prof. Rakesh Goel, Cal State Polytechnic University, SLO
  - ALL WORK PERFORMED UNDER THE DIRECTION OF MFD ENGINEERING.

LNGTEMS PROGRESS

- OFFSHORE PLATFORMS – Major issues resolved, incorporating comments from the MMS.
- FLOATING (FSRU) TYPE – No major issues, similar to API RPs for offshore floating production units.
- WHARF/PIER CONFIGURATIONS – Similar to the MOTEMS
- GRAVITY-BASED STRUCTURES – Minimal effort/guidance

LNGTEMS PROGRESS 11/07

- **FINAL REVIEW OF COMMENTS – TO AKER/KVAERNER:**

  Mechanical

  Piping

  Fire detection/suppression

  Electrical

MOST OF THESE COMPONENTS WILL HAVE COMMON REQUIREMENTS, NOT DEPENDENT ON CONFIGURATION.

LNGTEMS PROGRESS
Terminals Visited

- Costa Azul, Mexico
- Trunkline, Lake Charles, LA
- Eco Electrica, Puerto Rico
- Sodegaura LNG terminal, Tokyo, Japan

LNGTEMS REFERENCES
Hierarchy Issues

- NFPA 59A
- API RP 2A AND NEW API RP 2FB AND DRAFT API RP (Structural Integrity Management)
- MEXICAN LNG CODE
- VARIOUS DnV GUIDELINES
- EN 1473 CODE
- CFRs

LNGTEMS PROGRESS
Example Topic (Offshore Platforms)

TOPIC	GUIDANCE	LNG GUIDANCE	PROPOSED	AGREED
Seismic Spectra shape	API RP 2A ISO 19901-2	NFPA 59A refers to ASCE 7	ISO 19901-2	Use ISO 19901 w/ 2 spectral shapes

WHAT'S NEXT

- COMPLETE INITIAL DRAFT – JANUARY 2008
- ENGINEERING WORKSHOP IN HOUSTON, FEBRUARY 2008
- MODIFIED DRAFT MID 2008
- FINAL DRAFT FOR MFD ENGINERING REVIEW AND INTEGRATION – JULY 2008
- LNGTEMS READY FOR REGULATIONS – FIRST QUARTER, 2009 (Approx. 100-150 pages).

LNGTEMS CONCLUSIONS

- Will include four configurations
- Standards similar to the MOTEMS
- Workshops will include industry, regulators and consultants
- Code will be specific about hierarchy and guidance.